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Spatial variability of soil pH and phosphorus in relation to soil run-off following slash-and-burn land clearing in Sumatra, Indonesia

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Abstract

Slash-and-burn land clearing on sloping land may lead to increased soil run-off following disappearance of the protective vegetative cover. In turn, soil run-off and redeposition affects soil fertility and spatial patterns of fertility parameters in a field. This study seeks to clarify the role of spatial patterns of post-burn dead biomass (necromass) in soil run-off and redeposition and their combined effect on spatial patterns in soil pH and resin-extractable P. The study is carried out on a post-productive rubber (*Hevea brasiliensis*) agroforest in Sumatra, Indonesia. Soils are classified as Dystric Fluvisols. After slash-and-burn of vegetation, the field was planted with rubber seedlings and rice (*Oryza sativa*). For comparison the adjacent rubber agroforest site was sampled. Soil run-off is expressed here as the quantity of downward moving soil that passed the specific location of a flow trap. Existing physical soil run-off barriers and crop performance were scored. Despite serious soil run-off from the steeper upper slopes little soil was actually lost because of the slope form of the field, presence of natural soil run-off barriers, and the planted crop. Spatial variability of soil pH decreased at the expense of small-scale, within-strata, variability mainly because of the patchy distribution of soil run-off barriers. Soil run-off, aggravated by slash-and-burn, did not result in development of a clear soil fertility gradient down slope. In areas of high soil run-off potential, clear burns should be avoided because soil run-off barriers like remnants of slash-and-burn and surface litter maintain the soil and its fertility.

Keywords: Soil run-off; Slash-and-burn; Spatial variability; Soil pH; Resin-extractable P; Small-scale agriculture; Rubber plantation; Indonesia

1. Introduction

Slash-and-burn is a commonly used land clearing method at Sumatra, Indonesia (Van Noordwijk et al., 1998a). Slashing of secondary forest and post-productive agroforests or plantations, is followed by a primary broadcast burn. The remaining fuel is piled and set on fire a second time (secondary pile-burn). In farmers' perception this practice has clear benefits: it consumes slashed vegetation, increases field accessibility, provides a fertilizing layer of ash, improves soil structure and reduces weed tree competition as well as occurrence of pests and diseases (Ketterings et al., 1999). In contrast, fire

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